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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/827,318
Filing Date: April 20, 2004
Appellant(s): ASAHI ET AL.

Mr. Paul Bobwiec
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 02/17/2009 appealing from the Office action mailed 09/17/2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

2003/0136577	ABE	07-2003
2004/0095734	NAIR	05-2004

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-10, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abe (Pub. No. US 2003/0136577).

Abe discloses, as to claims 1, 5, 9, 16, a semiconductor device substrate comprised of a core substrate 10 (fig. 1) on both surfaces of which interconnect patterns 20 (20a, 20b), 24, 28 (fig. 1) are formed via a resin layer 14 (fig. 1), wherein the core substrate 10 is formed by a material (page 4, Table 1, paragraph [0053]) having a heat expansion coefficient, and a (first/outermost) resin layer 30 (fig. 1, page 3, paragraph [0045] and page 4, paragraph [0063], Table 1) is an outermost layer of the substrate 10 on each of the main surfaces thereof of material having at least one of a higher strength and a higher elongation than a resin material used for (second) inner resin layers 22 and 26 (fig. 1) in the substrate 10, and an outermost interconnect pattern 28 (fig. 1) of the semiconductor device substrate is coated by the resin layer 30 (fig. 1) forming the outermost layer of the semiconductor device substrate, and the outermost interconnect pattern 28 having a land (uncovered portions of the pattern 28) exposed through the outermost laver formed of the resin 30 (fig. 1; paragraph [0045]).

However, Abe does not explicitly state that the material for the core substrate is selected so that it is closer to that of a semiconductor chip than the respective heat expansion coefficients of the (third) main resin layers 14 (fig. 1) and the interconnect patterns 20, 24, 28 (fig. 1), wherein the core substrate 10 having respective interconnects patterns 24, 28 (fig. 1) extends through the resin layers 14, 22, 26, 30 (fig. 1).

Nonetheless, it would have been obvious to one of ordinary skill in the art at the time the invention was made to construct the invention of Abe with the selection of materials as provided in Table 1, since it is a prima facie obvious to an artisan for optimization and experimentation to select the available materials in Table 1 for the advantage of preventing cracking, deformation, and other problems arising in the substrate due to the thermal stress occurring between the core

substrate and the inner resin layers in the substrate and interconnect patterns in the substrate (see page 4, [0063]).

Note: The resin layers 14, 22, 26, 30 (fig. 1) may be selected among the disclosed group of materials (page 4, [0063]) so as to provide the outermost layer with the higher strength and elongation than the inner layer because the results are predictable.

Furthermore, when there is motivation: to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has a good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under § 103. KSR International Co. v. Teleflex Inc., 550 U.S. --, 82 USPQ2d 1385 (2007), KSR, 127 S. Ct. at 1742. These embodiments/materials demonstrate that there were a finite number of known techniques/materials for making a circuit board with high rigidity and reliability. The skilled artisan would have had good reason to try these materials, including core substrate material with a heat expansion of 4-10 ppm/°C, with a reasonable expectation of success. Thus, selecting the core substrate material with the heat expansion and the heat coefficient as claimed in the device is "the product not of innovation but of ordinary skill and common sense." KSR, 127 S. Ct. at 1742.

Moreover, Further, it has been held within a general skill of an artisan in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

As to claims 2 and 6, Abe further discloses that a resin layer 26 (fig. 1, page 3, paragraph [0045] and page 4, paragraph [0063], Table 1) under the resin layer 30 (fig. 1) forming the outermost layer of the substrate 10 is made of a resin material having at least one of a higher strength and higher elongation than the resin material of the resin layer 14 or 22 (fig. 1) used further inside the substrate 10 (fig. 1).

As to claims 3, 10, and 7, Abe further discloses that the resin material forming the outermost layer 30 has a fracture strength of at least 90 Mpa and elongation of at least 10%. (See page 4, paragraph [0063], Table 1) Note: example of such material is a polyimide resin.

As to claims 4, and 8, Abe discloses the resin material forming the outermost layer 30 (fig. 1) has a fracture strength of at least 90 Mpa and elongation of at least 10%. (See page 4, paragraph [0063], Table 1) Note: example of such material is a polyimide resin.

5. Claims 11-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abe in view of Nair (2004/0095734).

Abe discloses the invention substantially as claimed in the above rejection of claim 1, except that the core substrate being of a metal alloy.

Nair discloses an analogous device having a core substrate 211 (fig. 2E) made of an iron-nickel alloy (see page 2, paragraph [0026]) for providing a high capacitance substrate.

Therefore, as claims 11-15, it would have been obvious to one of ordinary skills in the art at the time the invention was made to have the material of the core substrate of Abe with the iron nickel alloy material, as taught by Nair, for providing the advantage as mentioned in the above.

Further, it has been held within a general skill of an artisan in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

(10) Response to Argument

A. First Ground of Rejection: Claims 1-10 and 16 under 35 USC 103(a) as being unpatentable over Abe.

1. The examiner acknowledges the law regarding to the obviousness issues (Br., p. 12).

2. The examiner respectfully disagrees with appellant's allegation (Br., p. 13) regarding to the rejection made as follows:

a) Regarding to claim 1, the examiner states in the rejection that Abe discloses a semiconductor device substrate comprised of a core substrate 10 (fig. 1) on both surfaces of which interconnect patterns 20 (20a, 20b), 24, 28 (fig. 1) are formed via a resin layer 14 (fig. 1), wherein the core substrate 10 is formed by a material (page 4, Table 1, paragraph [0053]) having a heat expansion coefficient, and a (first/outermost) resin layer 30 (fig. 1, page 3, paragraph [0045] and page 4, paragraph [0063], Table 1) is an outermost layer of the substrate 10 on each of the main surfaces thereof of material having at least one of a higher strength and a higher elongation than a resin material used for (second) inner resin layers 22 and 26 (fig. 1) in the substrate 10, and an outermost interconnect pattern 28 (fig. 1) of the semiconductor device substrate is coated by the resin layer 30 (fig. 1) forming the outermost layer of the semiconductor device substrate, and the outermost interconnect pattern 28 having a land (uncovered portions of the pattern 28) exposed through the outermost laver formed of the resin 30 (fig. 1; paragraph

[0045]). However, Abe does not explicitly state that the material for the core substrate is selected so that it is closer to that of a semiconductor chip than the respective heat expansion coefficients of the (third) main resin layers 14 (fig. 1) and the interconnect patterns 20, 24, 28 (fig. 1), wherein the core substrate 10 having respective interconnects patterns 24, 28 (fig. 1) extends through the resin layers 14, 22, 26, 30 (fig. 1). Nonetheless, it would have been obvious to one of ordinary skill in the art at the time the invention was made to construct the invention of Abe with the selection of materials as provided in Table 1, since it is a prima facie obvious to an artisan for optimization and experimentation to select the available materials in Table 1 for the advantages of preventing deformation, and improving rigidity and reliability arising in the substrate .

Further, it is noted that in Table 1 of Appellant's specification, appellant uses conventional epoxy resin for the inner layers and the polyimide resin for the outermost layer. Similarly to appellant's invention, Abe applies polyimide and epoxy resin materials (Abe, p. 4, para. [0052], Table 1), for the selected outer insulating resin layer 30 and inner insulating resin layers 26, 22. Polyimide and epoxy resin materials in Abe possess the same characteristics of strength and/or elongation as recited in the claims of the present invention, because Abe and the present invention's materials (polyimide and epoxy resin) are the same. However, Abe is silent regarding which material, polyimide or epoxy resin, constituted the outermost or the inner resin layer. Nonetheless, the selection of materials for the inner layers and the outermost layer lies within one of ordinary skill in the art to choose the desired material from the list disclosed in table 1 of Abe for the appropriate use, because polyimide resin and epoxy resin are well known materials in the art to have the desired characteristics of strength and elongation. Moreover, the

Board of Patent Appeals and Interferences has been consistent with its findings that "when there is a motivation to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has a good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious under § 103. *KSR International Co. v. Teleflex Inc.*, 550 U.S. --, 82 USPQ2d 1385 (2007), KSR, 127 S. Ct. at 1742." Therefore, given the material options available for the inner and outermost resin layers in Table 1 of Abe, the skilled artisan would have had good reason to try the epoxy resin material for the inner layers and the polyimide resin material for the outermost layer with a reasonable expectation of success.

Another, even if appellant had argued that the known resin materials were placed in such order that an unexpected result occurred, appellant's specification still fails to support such claim. In appellant's specification, para. [0017]-[0018], appellant merely attempts to provoke an unexpected result for the known materials by stating that experiments have been done regarding to the selection of the resin materials for the inner and outermost layers to show no cracks or degradation in the thermal test. However, the specification does not indicate how the alleged experiments were carried out, whether the alleged experiments were reliable and acceptable in the art, and what margin of error, if any, was attributable to the alleged experiments. It has been held that "conclusory statement in the specification does not suffice" regarding to any assertion of unexpected result. *In re De Blauwe*, 736 F. 2d 699, 705 (Fed. Cir. 1994) . Also, some of the aspects of Abe's invention are to prevent deformation such as strains, bowing, etc. (Abe, p. 4, [0052], Table 1), and to provide rigidity and reliability in connection

(Abe, p. 1, [0012], lines 4-5) between the board and the mounted circuit parts, which is in the same field of endeavors as that of the present invention. Therefore, the specification does not impart the claimed subject matter criticality, i.e. unexpected results. *In re Geisler*, 116 F. 3d 1465, 1470 (Fed. Cir. 1997).

With respect to appellant's argument (Br., p. 15) that Abe's core substrate is different from the present invention citing paragraph [0010] of Abe, the examiner notes that paragraph [0010] appears in the prior art discussion of Abe's invention which is not the invention of Abe. Abe teaches SiC as a core substrate material having a heat expansion coefficient of 4 ppm/^{0}C (Abe, p. 4, [0052], Table 1), which overlaps with the claimed range of 4-10 ppm/^{0}C. Thus, Abe meets the core substrate limitation.

For the foregoing reasons, claim 1 is properly rejected under 35 USC 103(a) as being unpatentable over Abe.

b) Claim 5: Appellant alleges that the examiner makes the same error in the rejection of claim 5 as that in claim 1. The examiner respectfully disagrees. As stated in the above, Abe's core substrate is different from the present invention citing paragraph [0010] of Abe, the examiner notes that paragraph [0010] appears in the prior art discussion of Abe's invention which is not the invention of Abe. Abe teaches SiC as a core substrate material having a heat expansion coefficient of 4 ppm/^{0}C (Abe, p. 4, [0052], Table 1), which overlaps with the claimed range of 4-10 ppm/^{0}C. Thus, Abe meets the core substrate limitation. Regarding to the resin materials selected for the inner layers and the outermost layer, the examiner's position has been stated in the above. Thus, claim 5 is rejected for the same reason as that of claim 1.

c) Claim 9: Appellant alleges that the examiner makes the same error in the rejection of claim 9 as that in claim 1. The examiner respectfully disagrees. As stated in the above, Abe's core substrate is different from the present invention citing paragraph [0010] of Abe, the examiner notes that paragraph [0010] appears in the prior art discussion of Abe's invention which is not the invention of Abe. Abe teaches SiC as a core substrate material having a heat expansion coefficient of 4 ppm/^{0}C (Abe, p. 4, [0052], Table 1), which overlaps with the claimed range of 4-10 ppm/^{0}C. Thus, Abe meets the core substrate limitation. Regarding to the resin materials selected for the inner layers and the outermost layer, the examiner's position has been stated in the above. Thus, claim 9 is rejected for the same reason as that of claim 1.

d) Claim 16: Appellant alleges that the examiner makes the same error in the rejection of claim 16 as that in claim 1. The examiner respectfully disagrees. As stated in the above, Abe's core substrate is different from the present invention citing paragraph [0010] of Abe, the examiner notes that paragraph [0010] appears in the prior art discussion of Abe's invention which is not the invention of Abe. Abe teaches SiC as a core substrate material having a heat expansion coefficient of 4 ppm/^{0}C (Abe, p. 4, [0052], Table 1), which overlaps with the claimed range of 4-10 ppm/^{0}C. Thus, Abe meets the core substrate limitation. Regarding to the resin materials selected for the inner layers and the outermost layer, the examiner's position has been stated in the above. Thus, claim 16 is rejected for the same reason as that of claim 1.

e) Claims 2-4: Regarding to claim 2, Abe discloses that a resin layer 26 (fig. 1, page 3, paragraph [0045] and page 4, paragraph [0063], Table 1) under the resin layer 30 (fig. 1) forming the outermost layer of the substrate 10 is made of a resin material having at least one of a higher strength and higher elongation than the resin material of the resin layer 14 or 22 (fig. 1) used

further inside the substrate 10 (fig. 1). Regarding to claim 3, Abe further discloses that the resin material forming the outermost layer 30 has a fracture strength of at least 90 Mpa and elongation of at least 10%. (See page 4, paragraph [0063], Table 1)(It is noted that the example of such material is a polyimide resin). Regarding to claim 4, Abe discloses the resin material forming the outermost layer 30 (fig. 1) has a fracture strength of at least 90 Mpa and elongation of at least 10%. (See page 4, paragraph [0063], Table 1) (It is noted that the example of such material is a polyimide resin.) Therefore, claims 2-4 fail to overcome the cited reference.

f) Claims 6-8: Regarding to claim 6, Abe discloses that a resin layer 26 (fig. 1, page 3, paragraph [0045] and page 4, paragraph [0063], Table 1) under the resin layer 30 (fig. 1) forming the outermost layer of the substrate 10 is made of a resin material having at least one of a higher strength and higher elongation than the resin material of the resin layer 14 or 22 (fig. 1) used further inside the substrate 10 (fig. 1). Regarding to claim 7, Abe further discloses that the resin material forming the outermost layer 30 has a fracture strength of at least 90 Mpa and elongation of at least 10%. (See page 4, paragraph [0063], Table 1)(It is noted that the example of such material is a polyimide resin). Regarding to claim 8, Abe further discloses that the resin material forming the outermost layer 30 has a fracture strength of at least 90 Mpa and elongation of at least 10%. (See page 4, paragraph [0063], Table 1)(It is noted that the example of such material is a polyimide resin). Therefore, claims 6-8 fail to overcome the cited reference.

B. Second Ground of Rejection: Claims 11-15 are rejected under 35 USC 103(a) as being unpatentable over Abe in view of Nair.

a) Regarding to claim 11, Abe teaches among other elements, as discussed in claim 1 above, a core substrate material made of SiC which has a heat expansion coefficient of 4 ppm/^{0}C

(Abe, p. 4, [0052], Table 1), which overlaps with the claimed range of 4-10 ppm/^{0}C. However, SiC is not a metal alloy as claimed. Nair discloses an analogous device having a core substrate 211 (fig. 2E) made of an iron- nickel alloy (see page 2, paragraph [0026]) for providing a high capacitance substrate. Therefore, it would have been obvious to one of ordinary skills in the art at the time the invention was made to substitute the SiC material of the core substrate of Abe with the iron nickel alloy material, as taught by Nair, for providing the advantage as mentioned in the above. Hence, Nair cures the deficiency in Abe.

b) Claim 13: Appellant repeats the argument of selecting the resin materials for the first, second and third resin layers similar to the discussion of the resin materials selection in claim 1 above. The examiner respectfully disagrees with appellant's allegation. (See the discussion in claim 1 above).

c) Claim 14: Appellant alleges that Abe and Nair do not teach the limitation. The examiner respectfully disagrees. (See the discussion of the selection of resin materials in claim 1 and the combined references, Abe and Nair, in claim 11 above).

d) Claim 12: Claim 12 falls with claim 11, as discussed in the above.

e) Claim 15: Claim 15 fall with claims 11 and 14.

For the foregoing reasons, claims 1-16 are rejected.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/(Vikki) Hoa B Trinh/

Examiner, Art Unit 2893

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